


2. Lynx Habitat Classification

In order to plan and manage effectively for lynx habitat through time, DNR has defined and classified lynx habitat based on the available scientific literature (Chapter 3 in the 1996 Lynx Plan (WDNR 1996a)). Emphasis was put on the needs of lynx in Washington State through adoption of the habitat classification system from the Washington Department of Wildlife report on Lynx status (WDW 1993).

There is still much to learn about lynx habitat relationships, and not all observations of lynx habitat occupancy will precisely fit this (or any) particular classification system. However, the system provides a foundation that can be adjusted as knowledge of lynx habitat relationships expands, and the categories can be easily monitored. Five categories are defined in this plan:

1. Open Areas
2. Temporary Non-lynx Areas
3. Forage Habitat
4. Denning Habitat
5. Travel Habitat

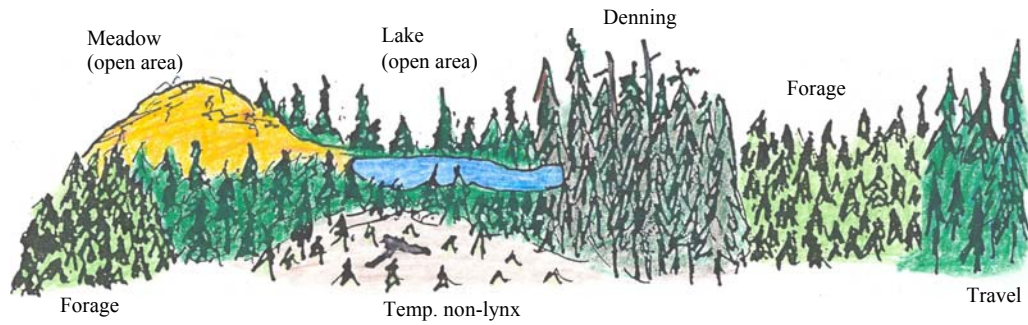
This classification system separates those areas within a landscape that are potentially usable by lynx (called “the lynx habitat matrix”) from those that are generally avoided (called “open areas”). The lynx habitat matrix is further divided in four categories by type of use. (See Table 2.1 and Figure 3). Within the matrix, currently forested habitats (Forage, Travel, and Denning Habitat) are separated from areas which have the potential to become lynx habitat in the future (Temporary Non-lynx Areas). Additional lynx habitat components—travel routes, travel corridors, and den sites—are also recognized.

Table 2.1
Lynx habitat classification system

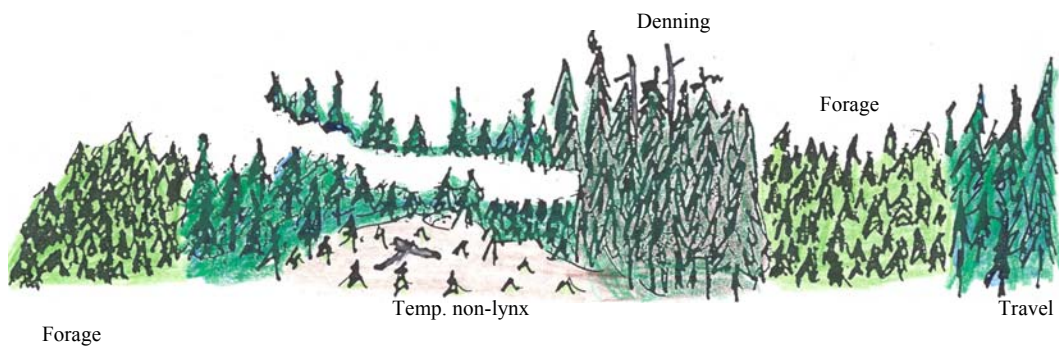
LANDSCAPE LEVEL MATRIX	COMPONENT	DESCRIPTION
Open Areas	Open Areas	Areas generally and permanently avoided by lynx: "permanent" or "natural" openings (e.g. meadows, lakes) not capable of meeting the requirements of lynx habitat.
Lynx Habitat Matrix		All habitats potentially used by lynx, either currently or in the future: areas capable of maintaining ≥ 180 tpa (445 trees/ha) or $\geq 40\%$ horizontal cover within 3.3 ft (1m) above average snow level (e.g. 4-8 ft from ground).
	Temporary Non-Lynx Areas	Areas temporarily avoided by lynx, in the process of becoming Forage or Travel Habitat: recently harvested, burned or other early successional sites, not yet attaining Forage or Travel Habitat status.
	Forage Habitat	Habitat where lynx consistently find high densities of snowshoe hare, especially in winter: stands with high horizontal cover provided by small diameter stems and branches, available above average snow level (< 4 zero scores per 40 readings from 1.5-2.0 m above ground).
	Denning Habitat	Habitat where lynx prefer to den; in order of preference: stands with known den sites, late seral stands of spruce/subalpine fir or similar mesic plant association with denning structure on northerly aspects, late seral stands with denning structure on mesic plant associations with other aspects, or late seral stands with denning structure on other plant associations.
	Denning Sites	The specific structure that lynx use as dens: deadfall (including upturned root wads) with large-end diameters of 6"(15 cm) or greater, layered such that there is an average of > 0.8 logs/yard (1 log/m) over a 150 foot (50 m) transect that are 1-4 feet (0.3 – 1.2 m) off the ground. Woody debris should cover the majority (75%) of a 5-acre (2 ha) patch.
	Travel Habitat	Forested habitat not otherwise classified as Forage Habitat or Denning Habitat, with ≥ 180 tpa (445 trees/ha) or $\geq 40\%$ horizontal cover within 3.3 ft (1 m) of average snow level
	Travel Routes	Linear landscape-level features that lynx often follow, such as major ridges, saddles, or riparian areas along rivers and streams.
	Travel Corridors	A special management zone at least 330 ft (100m) wide along Travel Routes, connecting Forage, Denning, or Travel Habitats.

Figure 3. Lynx Habitat Categories

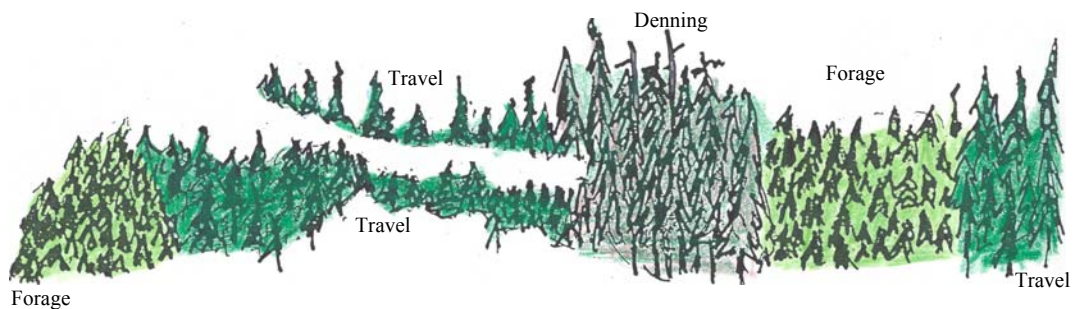
a) Partial landscape



**b) Lynx habitat matrix within the Landscape:
less permanently open (avoided) areas**



c) Forested lynx habitat



2.1 Open Areas

The **Open Areas** category is assigned to those areas within a landscape that lynx generally avoid. Open Areas can be characterized as non- or sparsely forested areas, including talus slopes, exposed rock surfaces, grassy meadows, low shrub fields, and other "permanent" openings that have little potential to provide thermal cover, favored prey, or security cover for lynx (Brittell et al. 1989, Koehler 1990a, Staples 1995).

In this plan, "Open Areas" refers to all sites that cannot maintain:

- at least 180 trees/acre (tpa) (445 trees/ha) where tree height reaches at least 3.3 feet (1m) above snow level, or
- horizontal cover of 40 percent or less between 3.3 - 6.6 feet (1-2 m above average snow cover).

2.2 Lynx Habitat Matrix

The lynx habitat matrix of a landscape includes all lands that are capable of supporting "forested" conditions—that is, stands that meet at least the minimum habitat standards for lynx. According to Koehler and Brittell (1990), the minimum habitat condition for lynx includes forest stands that contain at least 180 trees/acre (445 trees/ha) and that are at least 6 feet (2 m) tall where snows reach average depths of 2-3 feet (0.5-1 m), so as to provide enough cover to hide and shelter lynx in winter. This estimate was derived from Koehler (1990a) who observed that lynx crossed stands thinned to 170-260 trees/acre (420-640 trees/ha). These trees had diameter at breast height (dbh) of 5-9 inches (12-23 cm) and no understory cover was present. Alternatively, stands with fewer but larger trees that provide at least 70 percent canopy closure may provide "forested" conditions (in this case travel habitat) when "vertical structure" exists 4-8 feet (1.3-2.3 m) above ground (Lloyd 1999).

TEMPORARY NON-LYNX AREAS

Temporary Non-lynx Areas arise from wildland fire, regeneration harvests, or partially harvested stands and are <180 trees/acre and <8 feet tall (<445 trees/ha and <2.5 m tall). Forest roads and the associated right-of-ways count towards Temporary Non-Lynx Areas. Temporary Non-Lynx Areas have the potential to grow into forested lynx habitat (see following section). It is the potential to become habitat that distinguishes the lands in this category from those in Open Areas category. Therefore, Temporary Non-Lynx Areas are included as lynx habitat, whereas Open Areas are not.

Although lynx may avoid Temporary Non-lynx Areas as they do Open Areas, a complete description of lynx habitat must include Temporary Non-lynx Areas in enough quantity to continually maintain habitat for snowshoe hare. Because forests are constantly growing out of the reach of hare, forest managers must risk short-term displacement of lynx and hare remaining in mature forests in order to renew succession and ensure the continued presence of hare in sufficient quantities to support successful reproduction in lynx.

FORESTED HABITAT

Forested Habitat includes those stands that currently have at least 180 trees/acre, ≥ 8 feet tall (445 trees/ha and 2.5 m tall) or if they have less trees per acre, they have ≥ 40 percent horizontal cover for 3.3 feet (1 m) above average snow level. Within the portion of the lynx landscape that is currently forested (Figure 3, part c), lynx require at least two elements: 1) areas to hunt and sustain prey (forage), and 2) areas to den.

Forage Habitat

Forage Habitat includes stands that have the structure near ground and above the snow level that is capable of supporting snowshoe hares. Such stands may have various histories and classifications according to traditional forest practices. Forage Habitat may originate from wildland fire, regeneration harvests, thinning of mid-successional stands, or partial harvests of mature stands. Forage habitat also includes tall shrubby vegetation along wetlands or other riparian areas.

One of the main objectives of the effectiveness monitoring of the lynx plan that DNR conducted between 1997 and 2004 was to develop a better definition of forage habitat. The process and results of this effort are described in the effectiveness monitoring report presented in Appendix 2. The new definition of Forage Habitat is based on horizontal cover continuity using horizontal cover scores. Horizontal cover was estimated using a cover board viewed from 45 feet (15 m) distance at 5 to 7 feet (1.5 to 2 m) above ground level. Four horizontal cover readings are taken at each point along a transect comprised of 10 sample points. Scores were measured on an ordinal scale ranging from 0 (no cover) to 5, representing 20 percent cover by each numerical category. Scores of zero reflect the patchiness of available cover (horizontal cover continuity). Lynx Forage Habitat included those stands (20 acres or more) where less than 4 zero scores (views with no cover) are counted per 10 points measured (i.e. per 40 readings). The advantages of this definition over the 1996 Lynx plan definition of forage habitat are several - the scores are highly related to hare pellet densities, the field technique is easy to implement and gives high consistency between the observations, and some mature forests are included in the forage category.

Although Forage Habitat is presented in this plan as a separate habitat category, to truly manage for lynx, managers should manage for hare in all forested habitat. Relatively high density of snowshoe hare is needed on a landscape to accommodate the lynx needs. Ruggiero et al. (2000) report that minimum of 0.5 hares/ha are necessary to sustain lynx in northwestern Canada. Habitats other than young stands, such as mature forests and shrublands, should have some foraging role. This can be achieved by developing additional foraging opportunities for lynx in travel and denning habitats as well.

To encourage lynx persistence, prey must not only be abundant, but also vulnerable to predation. A number of factors may affect this vulnerability, including forest patch shape, size, and dispersion, as well as stand structure. Research suggests that snowshoe hare generally occupy denser habitat than lynx (O'Donoghue et al. 1998). Even if snowshoe hare are less vulnerable to lynx in some types of Forage Habitat (e.g. dense regeneration), it is assumed that hare will be vulnerable to predation in most habitats available to lynx in managed landscapes because:

- 1) most stands provide prime snowshoe hare habitat during a relatively small portion of a rotation (roughly 20 years out of 80),

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- 2) not all Temporary Non-lynx Areas will grow dense enough to produce high quality snowshoe hare habitat, and
 - 3) managed stands are likely to be less dense than unmanaged stands.⁴

It is therefore likely that high quality snowshoe hare habitat (densely forested sites where hare are less vulnerable) is the limiting type of Lynx Forage Habitat.

Denning Habitat and Den Sites

This plan recognizes Denning Habitat as stands that might support lynx dens such as those reported from north-central Washington (Koehler 1990a). However, only four dens by two females have been located in Washington (Koehler 1990a), and it is difficult to draw conclusions on such limited information. These were on north/northeast slopes, in mature subalpine fir/Engelmann spruce stands, under jack-strawed coarse woody debris.

In order of preference, Denning Habitat in this plan includes:

- stands with known den sites, late-seral stands of spruce/fir or similar mesic (medium moisture) association with denning structure on northerly aspects (exposures);
- late-seral stands with denning structure on mesic associations with other aspects;
- late-seral stands with denning structure on other associations.

Structure, in the form of debris piles or root tangles, is the common denominator in known den sites when data from other geographic locations are compiled (Slough 1999). See Table 5 of the 1996 Lynx Plan (WDNR 1996a) for qualitative descriptions of denning sites at various locations within lynx range. Mowat et al. (2000) also found that lynx did not appear to be constrained by specific stand types, but consistently selected areas with microsite structure, most commonly windthrown trees. For this reason, Den Sites are recognized in this plan. Den Sites are structures capable of being used by lynx as places to den. Denning structure includes deadfall with large-end diameters of 6 inches (15cm) or greater, layered such that there is an average of >0.8 logs/3 feet (>1 log per meter) over a 150-foot (50 m) transect that are 1-4 feet (0.3-1.2 m) off the ground. Deadfall includes upturned root wads.

Travel Habitat

All other forested habitats that do not fall into the specific categories of Denning Habitat or Forage Habitat are referred to as **Travel Habitat** in this plan. Travel Habitats maintain at least 180 trees/acre (445 trees/ha) that are at least 3.3 feet (1 m) above snow level, or have at least 40 percent horizontal cover for 3.3 feet (1 m) above average snow level (e.g., between 4 and 8 feet above ground). This habitat category may be important for providing lynx with access to alternative prey, low densities of snowshoe hare, cover during inclement weather, cover from predators, and for connecting Denning and Forage habitat.

⁴ Mowat and Slough (2003) likewise concluded that regenerating managed stands will rarely support lynx densities equal to those occurring in naturally regenerated burns.

Travel Routes

Given the presence of Temporary Non-lynx Areas and Open Areas within landscapes used by lynx, there is need for an additional habitat component. This component is not a separate habitat category. Rather, it is a linear feature to indicate potential routes of travel taken by lynx through landscapes that may be composed of any Forested Habitat category (Forage, Denning, Travel). These "travel routes" (after Koehler and Brittell 1990) follow the topographic features that already exist in the landscape, such as major ridges, saddles, rivers, and streams. Stable travel routes provide connections within the lynx habitat matrix and between habitat elements, facilitating the dispersal of kittens and movements of adults. For these reasons, travel routes are important habitat components at all scales of lynx habitat use.

Travel Corridors

A special management zone called a Travel Corridor straddles the route so that a >330 feet (100 m) wide corridor is available to lynx at all times. On average, the forested zone along a travel route will likely be much wider.

